

ENGLISH TRANSLATION OF THE INTERNATIONAL APPLICATION
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Claims

1. Control method for an actuator (1-4) of an injector of a fuel injection system for an internal combustion engine, which method has the following steps:

- specifying a target value (SOI_{SOI}) for the start of injection, and
- electrically controlling the actuator (1-4) at a specific trigger time ($t_{TRIGGER}$) with a specific actuator energy (E),
c h a r a c t e r i z e d b y
the following steps:
 - detecting an actual value ($SOI1_{IST}$, $SOI2_{IST}$, $SOI3_{IST}$, $SOI4_{IST}$) at the start of injection,
 - determining a deviation ($\Delta SOI1$, $\Delta SOI2$, $\Delta SOI3$, $\Delta SOI4$) between the target and actual values at the start of injection, and
 - setting the actuator energy (E) as a function of the deviation ($\Delta SOI1$, $\Delta SOI2$, $\Delta SOI3$, $\Delta SOI4$) between the target and actual values at the start of injection for controlling the start of said injection.

2. Control method according to claim 1
c h a r a c t e r i z e d i n t h a t
controlling takes place jointly for a plurality of actuators (1-4) by setting the actuator energy (E) jointly for a plurality of actuators (1-4).

3. Control method according to claim 2
c h a r a c t e r i z e d b y
the following steps:

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- detecting the actual value ($SOI1_{IST}$, $SOI2_{IST}$, $SOI3_{IST}$, $SOI4_{IST}$) at the start of injection separately for the individual actuators (1-4),
- determining the deviation ($\Delta SOI1$, $\Delta SOI2$, $\Delta SOI3$, $\Delta SOI4$) between the target and actual values at the start of injection separately for the individual actuators (1-4),
- determining the mean deviation (ΔSOI) between the target and actual values at the start of injection for a plurality of actuators (1-4), and
- setting the actuator energy (E) jointly for a plurality of actuators (1-4) according to the mean deviation (ΔSOI) between the target and actual values at the start of injection.

4. Control method according to claim 1
c h a r a c t e r i z e d i n t h a t
controlling takes place individually for in each case one of a plurality of actuators (1-4), with the actuator energy (E) being set in each case on an actuator-specific basis.

5. Control method according to claim 4
c h a r a c t e r i z e d b y
the following steps:

- detecting the actual value ($SOI1_{IST}$, $SOI2_{IST}$, $SOI3_{IST}$, $SOI4_{IST}$) at the start of injection separately for the individual actuators (1-4),
- determining the deviation ($\Delta SOI1$, $\Delta SOI2$, $\Delta SOI3$, $\Delta SOI4$) between the target and actual values at the start of injection separately for the individual actuators (1-4), and
- setting the actuator energy (E) separately for the individual actuators (1-4) as a function of the respective

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actuator-specific deviation ($\Delta SOI1$, $\Delta SOI2$, $\Delta SOI3$, $\Delta SOI4$) between the target and actual values at the start of injection.

6. Control method according to one of the preceding claims characterized in that the trigger time ($t_{TRIGGER}$) for controlling the actuators (1-4) is set independently of the deviation ($\Delta SOI1$, $\Delta SOI2$, $\Delta SOI3$, $\Delta SOI4$) between the target and actual values at the start of injection.

7. Control method according to one of claims 1 to 5 characterized in that as part of controlling and in addition to setting the actuator energy (E), the trigger time ($t_{TRIGGER}$) is also set as a function of the deviation ($\Delta SOI1$, $\Delta SOI2$, $\Delta SOI3$, $\Delta SOI4$) between the target and actual values at the start of injection for controlling said start of injection.

8. Control method according to claim 7 characterized in that the actuator energy (E) is set jointly for a plurality of actuators (1-4) while the trigger time is set separately for the individual actuators (1-4).

9. Control method according to one of the preceding claims characterized in that the actual value ($SOI1_{IST}$, $SOI2_{IST}$, $SOI3_{IST}$, $SOI4_{IST}$) at the start of injection is detected by means of a seat contact switch (6-9), with said seat contact switch (6-9) detecting a valve needle position of the injector.

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10. Control method according to one of the preceding claims characterized in that the actuator energy (E) is set within the scope of controlling on a discrete time and/or on a discrete value basis.

11. Control device for an actuator (1-4) of an injector for a fuel injection system of an internal combustion engine, which device has

- a controlling element (5, 5.1-5.4) for electrically controlling the actuator (1-4) at a specific trigger time (t_{TRIGGER}) with a specific actuator energy (E) characterized by
- a measuring device (6-10) for detecting an actual value (SOI1_{IST} , SOI2_{IST} , SOI3_{IST} , SOI4_{IST}) at the start of injection,
- a first controller (16, 16.1-16.4) for setting the actuator energy (E) as a function of a deviation (ΔSOI1 , ΔSOI2 , ΔSOI3 , ΔSOI4) between the measured actual value (SOI1_{IST} , SOI2_{IST} , SOI3_{IST} , SOI4_{IST}) at the start of injection and a pre-specified target value (SOI_{SOLL}) at the start of injection.

12. Control device according to claim 11 characterized in that the actuator energy (E) can be set jointly within the scope of controlling for a plurality of actuators (1-4).

13. Control device according to claim 12 characterized by a computing unit (15) for calculating a mean value (ΔSOI) of the deviation (ΔSOI1 , ΔSOI2 , ΔSOI3 , ΔSOI4) between the target and actual values at the start of injection for a plurality of actuators (1-4), with the first controller (16) setting the

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actuator energy (E) for a plurality of actuators (1-4) in keeping with the mean value (ΔSOI).

14. Control device according to claim 11
c h a r a c t e r i z e d i n t h a t
the actuator energy (E) can be set individually within the scope of controlling for a plurality of actuators (1-4).

15. Control device according to one of claims 11 to 14
c h a r a c t e r i z e d b y
a second controller (18) for setting the trigger time (t_{TRIGGER}) for controlling the actuator (1-4) as a function of the deviation ($\Delta SOI1$, $\Delta SOI2$, $\Delta SOI3$, $\Delta SOI4$) between the measured actual value ($SOI1_{\text{IST}}$, $SOI2_{\text{IST}}$, $SOI3_{\text{IST}}$, $SOI4_{\text{IST}}$) at the start of injection and the pre-specified target value (SOI_{SOLL}) at the start of injection.

16. Control device according to one of claims 11 to 15
c h a r a c t e r i z e d i n t h a t
the measuring device (6-10) has a seat contact switch 69) which detects a valve needle position of the injector.